a switch engine that determines whether said first record exists in said flow table when said layer 2 flow is detected, and whether said second record exists in said flow table when said layer 3 flow is detected.

REMARKS

Following entry of the above amendments, claims 1-25 and 27-44 are presently pending in the application. The Examiner indicated that claims 32-43 are allowable over the art of record. The Examiner further objected to claims 2, 3, 7, 13, 16, 17, 18-21, 26, and 31 as being dependent upon a rejected base claim, but indicated that these claims would be allowable if rewritten in independent form including all of the limitations of the base claims and any intervening claims.

Applicants thank the Examiner for reviewing the art of record and for examining the previously pending claims. Applicants have cancelled claim 26 without prejudice, added new claim 44, and have amended claims 13, 15, 25, 27, 29, and 35 to better characterize and to more particularly point out Applicants claimed invention and to place the claims in condition for allowance. Applicants respectfully submit that the claims as presently pending are allowable and respectfully request reconsideration and allowance of the presently pending claims.

Prior Art Rejection of Claims 1, 4, 5, 8-12, 14, 15, and 24 As Anticipated By Murthy

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Claims 1, 4, 5, 8-12, 14, 15, and 24 stand rejected under 35 U.S.C. §102(b) as allegedly

being anticipated by U.S. Patent No. 5,610,905 to Murthy et al. ("Murthy").[1] For reasons set forth

more fully below, this rejection is respectfully traversed.

<u>Murthy Does Not Disclose Or Suggest Forwarding Packets Between Hosts In Accordance With
Layer 2 And Layer 3 Addresses And Records In A Common Flow Table As Required By
Independent Claim 1</u>

Independent claim 1 requires:

1. An apparatus for forwarding packets between ports, said ports associated with hosts
having one or more of a layer 2 address, a layer 3 address and a socket number, said apparatus
comprising:
 a flow table having a plurality of records;
 a switch module coupled to said ports and said flow table, said switch module comprising:
  means for forwarding a first packet between a first host and a second host **in
accordance with a first record in said flow table and said layer 2 addresses** of said first and
second hosts, and
  means for forwarding a second packet between a third host and a fourth host **in
accordance with a second record in said flow table and said layer 3 addresses** of said third and
fourth hosts.

Applicants disclose and claim a multiprotocol switch that in exemplary embodiments

performs switching of packets using layer 2 MAC (Ethernet) machine specific addresses,

switching of packets within the same network using layer 3 IP and IPX protocol, and routing of

packets between different networks. In an exemplary embodiment, incoming data packets are

examined and the flow with which they are associated is determined. The flow typically includes

the source node, the application running on the source node that is initiating the connection and

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[1] Although the Official Action states that claims 7-10, among others, are rejected under 35 U.S.C.
§102(b), it is believed that this is a typographical error, and the Official Action should state that
claims 8-10 are rejected. The Examiner indicated elsewhere in the Action that claims 2 and 7,
among others, would be allowable if rewritten in independent form. As claim 7 is dependent on
claim 2, and claim 2 was unambiguously considered by the Examiner allowable if rewritten, it is
Applicants interpretation that claim 7 is allowable if rewritten in independent form.

generating the packets, the destination node, and the application on the destination node to which

the packet traffic is destined. A flow table contains forwarding information that can be applied to

the flow. If an entry is not present in the flow table for a particular flow, the packet is forwarded

to a CPU to be processed. The CPU assists in performing routing functions where necessary, and

in general, the CPU extracts the flow information from the packet and updates the flow table

with forwarding information to be applied to all future packets belonging to the same flow. When

the forwarding information is already present in the table, packets can thus be forwarded between

ports of the switch with no processor intervention at wire speed (page 5, lines 5-13, Figures 6-8).

Once flow table entries are established, the switch is capable of performing wire-speed switching

and routing regardless of whether all nodes coupled thereto belong to IP/IPX networks (layer 3)

or non-IP/IPX networks (layer 2) or any combination thereof (layer 2 and 3) (pp. 28-29).   An

exemplary flow table includes an address resolution record table that contains a list of address

resolution records that provide forwarding information for each communication node and an

address resolution hash that contains pointers to the records (page 16). The flow table contains

entries for layer 2 flow and layer 3 flow as applicable. Bucket hashing is used in this example

flow table to sort the flow information to enable searching through the list of address resolution

records faster than a convention flow table arrangement (for example, page 16, lines 15-16,

Figure 5).

    With regard to the invention as claimed, the apparatus of independent claim 1 includes a

switch module. The switch module includes a means for forwarding a first packet between a first

host and a second host in accordance with a first record in the flow table and the layer 2

addresses of the first and second hosts. In layer 2 forwarding, packets are forwarded based on

source and destination Ethernet addresses (page 8, lines 19-20). Claim 1 assumes that a record

for layer 2 flow exists in the flow table. An example of layer 2 flow where flow table entries

must initially be created is in Applicants' specification at pp. 29-30. The switch module further

includes a means for forwarding a second packet between a third host and a fourth host in

accordance with a second record in the flow table and the layer 3 addresses of the third and

fourth hosts. In layer 3 forwarding, packet traffic may be switched between nodes that belong to

the same routing domain, or routed between nodes that belong to different routing domains, at

wire speed (page 9, lines 9-11). Claim 1 assumes that a record for layer 3 flow exists in the flow

table. An example of layer 3 flow where flow table entries must initially be created is in

Applicants' specification at pp. 30-32. **The means for forwarding each utilize a record from**

the same flow table of records to perform the respective forwarding of packets. The flow

table of claim 1 has records that may be used in conjunction with layer 2 and layer 3

addresses as applicable.

By contrast, Murthy discloses multi-port packet-based bridge and router embodiments in

which packet transmissions on particular ports or between ports may be monitored on another,

monitoring port. Murthy discloses a layer 2 MAC (Ethernet) bridge, having a bridging table.

The bridging table includes Ethernet station addresses and corresponding port numbers on the

bridge (Murthy, Figure 4, col. 6, lines 39-56). The bridge table may contain static or dynamically

updated addresses and port numbers, but deals solely with corresponding Layer 2 addresses with

port numbers.

Murthy further discloses "physically and/or logically incorporating" a router in a bridge.

The Examiner notes that a router is a layer 3 device and, presumably, the Examiner's logic is that

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therefore Murthy forwards packets according to layer 3 addresses. Murthy does not disclose or suggest integrating the bridges and routers together to forward packets from a common flow table. Rather, the focus of Murthy on bridges and routers appears to be to illustrate that the packet monitoring and implementation of custom filtering rules (CFRs) can be applied to routers as well as to MAC bridges (Murthy, col. 4, lines 21-23). The bridge of Murthy does not perform a routing function or forwarding of packets in layer 3, rather it forwards packets to a router for further processing by utilizing the layer 2 Ethernet address of the router as the destination address (DA) of the packet (for example, Murthy, col. 9, lines 32-34). This is, of course, layer 2 forwarding. Murthy discloses that a router possibly has its own routing table for translating network addresses into ports and network destinations (Murthy, col. 22, lines 46-47). One cannot infer from Murthy's suggestion to physically or logically incorporate a router with a bridge, the bridge having the layer 2 bridging table of Figure 5, that forwarding functions would thus be integrated so that forwarding of packets would be performed in accordance with layer 2 and layer 3 addresses and respective records from the same flow table.

Therefore, Murthy does not disclose or suggest integrating the functions of the router and the bridge to provide a common flow table that is used to forward packets according to both layer 2 and layer 3 addresses.

Another difference exists, although not claimed in independent claim 1, between the bridge of Murthy and embodiments of Applicants. In Murthy, the bridge CPU is primarily responsible for forwarding packet traffic according to layer 2 source and destination address fields and the port number on which the packet is queued (for example, Murthy, col. 13, lines 1-7; col. 13, lines 63-64, col. 14). By contrast, Applicants disclose embodiments including a CPU

that intervenes when layer 2 or layer 3 flow information, such as a destination address, is not found in the flow table, or when routing of packets between different networks is required. Following update of the flow table by the CPU, the multiprotocol switch forwards, switches, and routes packets at wire speed at layer 2 or layer 3 within a network or between networks, as applicable. Again, a common flow table is used for both layer 2 and layer 3 forwarding.

Accordingly, Applicants submit that independent claim 1 is allowable over the art of record. Previously rejected claims 4-6 and 8-10, and objected to claims 2, 3, and 7, all ultimately depend from claim 1. The allowability of claims 2-10 thus follows from the allowability of claim 1; as such, claims 2-10 are allowable over the art of record.

Murthy Does Not Disclose Or Suggest A Flow Table Including Address Resolution Records That Correspond Ports With Respective Layer 2 And Layer 3 Addresses As Defined In Independent Claim 11

Independent claim 11 requires:

a flow table comprising a plurality of address resolution records including:
a first address resolution **record that corresponds said first port with said first layer 2 address,**
a second address resolution **record that corresponds said first port with said first layer 3 address,**
a third address resolution **record that corresponds said second port with said second layer 2 address, and**
a fourth address resolution **record that corresponds said second port with said second layer 3 address; and**
a switch module coupled to said ports and said flow table that detects said layer 2 flow arriving at one of said first and second ports, and forwards packets belonging thereto to the other of said first and second ports based on said first and third address resolution records, said switch module also detects said layer 3 flow arriving at one of said first and second ports, and forwards **packets belonging thereto to the other of said first and second ports based on said second and fourth** address resolution **records.**

Even more particularly than independent claim 1, independent claim 11 recites records in a flow table that correspond ports with layer 2 and layer 3 addresses as applicable and forwarding packets between ports based on the records. As discussed above, Murthy discloses a layer 2 bridge that forwards packets at layer 2, including packets to be routed. Despite disclosing router embodiments, Murthy does not explicitly teach layer 3 forwarding, and Murthy does not teach layer 2 and layer 3 packet forwarding from the same flow table. In particular, Murthy does not disclose or suggest a flow table including address resolution records that correspond ports with layer 2 _and_ address resolution records that correspond ports with layer 3 addresses.

Applicants submit that independent claim 11 is allowable over the art of record. Previously rejected claims 12, 14-15, and 22-24, and objected to claims 13, and 16-21, all ultimately depend from independent claim 11. The allowability of claims 12-24 thus follows from the allowability of claim 11; as such, claims 12-24 are allowable over the art of record.

Prior Art Rejection of Claims 29 and 30 As Anticipated By Sunada

Claims 29 and 30 stand rejected under 35 U.S.C. §102(b) as allegedly being anticipated by U.S. Patent No. 5,572,533 to Sunada et al. ("Sunada"). For reasons set forth more fully below, this rejection is respectfully traversed.

Independent claim 29 requires:

if said protocol identifier is IP or IPX:
    determining whether said first packet needs to be switched within the same network or routed between different networks;
    if said first packet needs to be switched, switching said first packet between said first port and a second port based on a first record from said flow table and one of said IP or IPX address of said first packet; and
    if said first packet needs to be routed, routing said first packet between said first port and a third port based on a second record from said flow table and one of said IP or IPX address of said first packet; and
    if said protocol identifier is not IP or IPX:

switching said first packet between said first port and a [third] <u>fourth</u> port based on a third record from said flow table and said Ethernet address of said first packet.

Applicants explain the operation of a multiprotocol switch according to the present invention in the specification at, for example, pages 20-21 referencing Figure 6. The switch determines whether the protocol used by the hosts of the flow associated with the packet is IP or IPX (pg. 20, lines 16-17). If the protocol type (protocol identifier) is IP or IPX, a further determination is made whether the packet needs to be switched or routed (pg. 20, lines 17-18). If, for example, the destination Ethernet address (layer 2) in the packet is not the Ethernet address of the switch, then the packet needs to be switched within the same network and the packet is switched in accordance with IP or IPX flow information (layer 3) as applicable (pg. 20, lines 18-20; pg. 21. line 1). The switch provides layer 3 switching of the packet between ports of the switch based on a record in the flow table and on the IP or IPX address as applicable (see for example pp. 20-23 and Figure 7). If the destination Ethernet address (layer 2) in the packet is the Ethernet address of the port of the switch and the destination IP or IPX address does not correspond to that of the switch, the packet is to be routed between different networks.

In contrast to the claimed invention, Sunada describes the process flow of a prior art router in Fig. 5 (Sunada, col. 2, lines 4-29; Fig. 5). Sunada discloses determining whether or not a packet must be routed, and steps to be taken if a packet only has a MAC (Ethernet) address and is not to be routed. Sunada does not disclose or suggest determining whether a packet, if the protocol of the packet is IP or IPX, needs to be switched within the same network as required by independent claim 29. As regards the IP protocol, Sunada states that if the packet has an IP address and a MAC (Ethernet) address the packet must be routed (col. 2, lines 12-14). If the

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packet only has a MAC address, the packet "involves a protocol specific to a manufacturer and must not be routed" (col. 2, lines 14-16). In this event, Sunada discloses checking the MAC address, and if the address must be blocked, forwarding the packet onto a LAN with a MAC (layer 2) bridge (col. 2, lines 25-29). Sunada thus merely discloses layer 2 forwarding (*switching*) for non-IP (MAC only) protocols and layer 3 *routing* for IP protocols. Nowhere does Sunada disclose or suggest switching a packet between ports based on the IP address of the packet, as required by independent claim 1. Further, Applicants can find no instance in which Sunada mentions the IPX protocol with regard to any topic, let alone with reference to routing or switching.

The claimed invention of Applicants requires preparing a flow table including a plurality of records. Packets (IP or non-IP, IPX or non-IPX) are routed or switched as applicable based on IP, IPX, or Ethernet addresses as well as on records from the *same*, or from a common, flow table. Sunada discloses a router with a well-known routing table for routing of IP protocol packets (col. 2, lines 21-23). Sunada discloses a MAC bridge but does not explicitly disclose a flow table; even presuming a flow or other such table, there is no suggestion of a common layer 2 and layer 3 flow table (col. 2, lines 27-29). As such, if the flow table is considered the routing table, Sunada does not disclose switching the non-IP or non-IPX protocol packet based on a record from the routing table. Of course, since Sunada does not disclose or suggest switching IP or IPX packets within the same network, there is no mention of a flow table that is utilized to do so. It is abundantly clear from Sunada that the flow table of independent claim 29 is not disclosed or suggested therein. Conventional routers and bridges, packaged together or packaged separately, do not meet the requirements of independent claim 29.

In summary, independent claim 29 is allowable for at least the following reasons:

Sunada does not disclose or suggest switching an IP protocol packet between ports based on a record from a flow table and the IP address of the packet, i.e. IP switching within the same network.

Sunada does not distinguish between switching an IP protocol packet within the same network and routing an IP protocol packet between different networks.

Sunada does not disclose or suggest or make reference to the IPX protocol.

Sunada does not disclose or suggest switching an IP protocol packet, routing an IP protocol packet, or switching a non-IP or non-IPX protocol packet based on records from a common flow table.

Applicants have amended claim 29 for clarification purposes to recite switching the first packet between the first port and a "fourth" port rather than a "third" port based if the protocol identifier is not IP or IPX. No new matter has been added. The amendment does not change claim 29 in a substantive way and the arguments described above apply fully to amended claim 29.

Accordingly, Applicants submit that amended independent claim 29 is allowable over the art of record. Previously rejected claims 30 and objected to claim 31 are dependent on amended claim 29. The allowability of claims 30 and 31 thus follows from the allowability of amended claim 29; as such, claims 30 and 31 are allowable over the art of record.

Prior Art Rejection of Claims 6, 22, and 23 As Unpatentable Over Murthy

Claims 6, 22, and 23 stand rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over the Murthy reference. For reasons set forth more fully below, this rejection is respectfully traversed. Claim 6 is ultimately dependent on independent claim 1 through claim 5. For at least the reasons presented above, the subject matter of claim 1 is not disclosed or suggested by Murthy. The allowability of dependent claim 6 follows therefrom.

Claims 22 and 23 are both dependent on independent claim 11. For at least the reasons presented above, the subject matter of claim 11 is not disclosed or suggested by Murthy. The allowability of dependent claims 22 and 23 follows therefrom.

Prior Art Rejection of Claims 25, 27, and 28 As Unpatentable Over Murthy In View Of Spinney

Claims 25, 27, and 28 stand rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over the Murthy reference in view of U.S. Patent No. 5,390,173 to Spinney.

The Examiner indicated that claim 26 would be allowable if rewritten in independent form. Applicants have amended independent claim 25 to incorporate matter from previously pending claim 26. Claim 25 now recites the acts of corresponding a swap address, receiving a second data packet, and routing the second data packet. Amended claim 25 is identical to the combination of previously pending claims 25 and 26, except amended claim 25 recites "a second address", the second address being within the second data packet rather than "an address" within the second data packet. Applicants have amended claim 27 for proper antecedent basis, to be consistent with the language of amended independent claim 25, and to clarify what Applicants consider their invention, consistent with Applicants' specification. No new matter has been added.

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Accordingly, Applicants submit that amended independent claim 25 is allowable over the art of record. Previously rejected claims 27 and 28 ultimately depend from independent claim 25. Claim 26 is cancelled without prejudice. The allowability of claims 27 and 28 thus follows from the allowability of claim 25; as such, claims 27 and 28 are allowable over the art of record.

Allowable Subject Matter

The Examiner further objected to claims 2, 3, 7, 13, 16-21, 26, and 31 as being dependent upon a rejected base claim, but indicated that these claims would be allowable if rewritten in independent form including all of the limitations of the base claims and any intervening claims. For these reasons and for at least the reasons presented above with regard to allowability of the independent claims to which these claims respectively depend, Applicants respectfully submit that claims 2, 3, 7, 13, 16-21, and 31 are allowable. Claim 26 has been cancelled without prejudice.

Newly Added Claims

New claim 44 is a new version of independent claim 1 with the additional recitation of means for detecting layer 2 flow and means for detecting layer 3 flow as well as a switch engine that determines whether the first record exists in the flow table when the layer 2 flow is detected, and whether the second record exists in the flow table when the layer 3 flow is detected. No new matter has been added. Consistent with the Examiner's indication of allowable subject matter in claim 20, as well as with the arguments presented above, Applicants believe new claim 44 to be allowable over the art of record and respectfully request entry and consideration of new claim 44.

Amended Claims

Claims 25, 27, and 29 have been discussed above.

Applicants have amended claim 13 for proper antecedent basis and to be consistent with the language of independent claim 11. Amended claim 13 recites "layer 2 flow" rather than "first flow" and "layer 3 flow" rather than "second flow." No new matter has been added.

Finally, Applicants have amended claims 15 and 35, in each instance to remove an additional period at the end of the claim sentence. No new matter has been added.
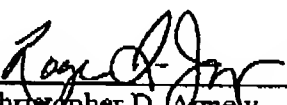
Applicants respectfully request entry of the above amendments. Following entry of the above amendments, Applicants respectfully submit that claims 1-25 and 26-44 are allowable over the art of record and ask for reconsideration and an allowance of the aforementioned claims.

Conclusion

Having fully and succinctly addressed every objection and rejection identified in the Office

Action with the above amendments, it is submitted that this application is in condition for

allowance. A Notice to that effect is earnestly solicited.

Respectfully submitted,

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I certify that this paper is being deposited for delivery via First Class mail to the U.S. Patent Office, Attn Assistant Commissioner for Patents, with appropriate postage affixed thereto, on August 21, 2000.

Jeanette Walker